Plant Document Analysis

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End of Engineering Analysis Report

ENGINEERING SPECIFICATION ANALYSIS

Focus Area: Nozzle Load Analysis

Generated on November 21, 2025

Accepted Specifications for Evaluation of Nozzle Load Analysis

• Appendix P (Addition) — "Allowable External Loads on Tank Shell Openings": table of required design loads at the nozzle-to-shell junction for shell-mounted nozzles, with specified radial loads, circumferential moments and longitudinal moments for nozzle nominal sizes 3" through 24". (Table reproduced in the document; see Measurements section for numeric values.)

• Statement that nozzle loadings shown in the table "apply at the nozzle to shell junction."

• Statement that "Nozzle loads that are higher than those listed in the table may be specified by CONSTRUCTION MANAGER" and that "CONTRACTOR shall be responsible to confirm the acceptability of the specified external nozzle and support pad loading or advise the maximum loading acceptable for the tank design."

• Requirement: "Loadings for nozzles greater than 24 inch NB are to be agreed between CONTRACTOR and CONSTRUCTION MANAGER."

• Vendor data requirement (12.2.viii): "Nozzle load Analysis" is explicitly required submittal during Manufacturing & site erection.

• Reinforcement/attachment requirement (5.8.2 Addition): "Reinforcement or bearing plates shall be added to the tank bottom under all concentrated loads such as heating coils, support legs for floating roofs, fixed columns, etc." (relevant where under-bottom connections concentrate loads).

• Minimum distance from bottom to centre line of any nozzle or manway: "shall be as per API Standard 650 for regular nozzles – table 5.6a." (document references API 650 table 5.6a as the governing minimum but does not state numerical values).

• Flange standard for large nozzles (5.7.6.1.a Addition): "Nozzle flanges above 24" NB (except man ways) shall be as per ANSI B16.47 Series – B Type."

• Appendix B / anchorage note (B.7, B.8, 5.12.*): where anchoring is required, "CONTRACTOR is to specify all anchor bolt loadings" and "CONTRACTOR shall furnish recommendations for ... number of bolts and the bolt circle diameter ... threaded length..." (relevant when nozzle loads contribute to overall foundation/anchor design).

• Appendix P requires: "CONTRACTOR shall provide calculations justifying the acceptability of the specified loading." (i.e., analysis deliverable requirement).

• Statement that Appendix O (Under-Bottom Connections) is mandatory for all under-bottom connections — relevant if nozzle is an under-bottom connection.

Measurements Provided in Document

• Nozzle loading table (applies at nozzle-to-shell junction). Explicit numeric values provided in the document:

• " NB: Radial load = 1000 N; Circumferential moment = 200 Nm; Longitudinal moment = 200 Nm.

• " NB: Radial load = 1500 N; Circumferential moment = 300 Nm; Longitudinal moment = 300 Nm.

• " NB: Radial load = 2500 N; Circumferential moment = 700 Nm; Longitudinal moment = 700 Nm.

• " NB: Radial load = 4000 N; Circumferential moment = 1500 Nm; Longitudinal moment = 1500 Nm.

• " NB: Radial load = 5000 N; Circumferential moment = 2500 Nm; Longitudinal moment = 2500 Nm.

• " NB: Radial load = 7000 N; Circumferential moment = 4000 Nm; Longitudinal moment = 4000 Nm.

• " NB: Radial load = 9000 N; Circumferential moment = 6000 Nm; Longitudinal moment = 6000 Nm.

• " NB: Radial load = 11000 N; Circumferential moment = 8000 Nm; Longitudinal moment = 8000 Nm.

• " NB: Radial load = 13000 N; Circumferential moment = 10000 Nm; Longitudinal moment = 10000 Nm.

• " NB: Radial load = 15000 N; Circumferential moment = 13000 Nm; Longitudinal moment = 13000 Nm.

• " NB: Radial load = 20000 N; Circumferential moment = 18000 Nm; Longitudinal moment = 18000 Nm.

• Statement: "Loads are considered negligible" for nozzle size "2 and below" (i.e., ≤2" NB).

• Minimum anchor bolt size when anchors provided: "Minimum size of anchor bolt shall be M33" (Appendix B / F).

• Corrosion allowance for anchor components: "Corrosion allowance is to be a minimum of 6mm (0.25 inch)" (5.12.5 Addition).

• Reinforcement plate thickness under pipes discharging against tank bottom: "Wear plates 6 mm (0.25 inch) thick shall be installed under pipes discharging against the tank bottom." (5.8.2 Addition)

• Reference values for wind design that can affect external piping support loads (5.2.2 Addition): Terrain Category = 2, Group = B, K1 = 1.08, K2 = 1.1, K3 = 1.0, Wind Speed = 50 m/s, Shape Factor = 0.7. (These are explicit document parameters that may influence piping loads transferred to nozzles.)

Inputs and Additional Requirements from Client

• Explicit client-provided inputs (document statements):

• "OWNER will provide basic configuration, service data, design requirements and all other applicable loads. These shall be specified on the tank data sheet and in this specification." (5.3)

• Tank Data Sheets: "The specific requirements for individual tanks are given in the Tank Data Sheets." (Supplement to API 650, Scope)

• Vendor data requirement: vendor must submit "Design Calculations" and specifically "Nozzle load Analysis" during manufacturing & site erection (12.2.vi and 12.2.viii).

• Explicit requests/requirements in document that indicate missing information for a complete nozzle load analysis:

• The document requires Contractor to "confirm the acceptability of the specified external nozzle and support pad loading or advise the maximum loading acceptable for the tank design." (Appendix P) — implies the actual piping loads and support-pad configurations must be provided to/verified by the CONTRACTOR; these are not present in this document.

• Appendix P allows higher nozzle loads if specified by CONSTRUCTION MANAGER — the document does not list any project-specific increased nozzle loads; such specified higher loads (if any) must be provided on the Tank Data Sheet or by CONSTRUCTION MANAGER.

• Minimum distance from tank bottom to nozzle centreline is referenced to API 650 table 5.6a, but the document does not give the numerical minimum distances — the tank data sheet or API 650 table 5.6a values are therefore required for clearance checks.

• No nozzle-by-nozzle sizes, locations (elevation and circumferential position), orientations, pad details, or piping load cases are given in this specification document — these are required inputs (explicitly: "basic configuration, service data, design requirements and all other applicable loads" on the tank data sheet).

• CONTRACTOR must "provide calculations justifying the acceptability of the specified loading" (Appendix P) — the specification does not include such calculations; they must be produced by vendor.

• For under-bottom connections, Appendix O is mandatory — the specification does not include specific under■bottom nozzle load values or details; such inputs are required when under-bottom nozzles exist.

• For anchor/foundation interactions where nozzle loads are significant, CONTRACTOR must specify anchor bolt loadings and other anchorage details; those are not provided in this document and must be supplied.

Notes / Scope control

• I have listed only items explicitly stated in the provided document that are relevant to conducting a nozzle load analysis (standards/requirements, numeric nozzle loading table, deliverable requirements and referenced parameters). No assumptions or inferred nozzle locations, sizes beyond the table, or piping load cases have been added.

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